

## Implementation of an Acoustic Emission Proximity Detector for Use in Generating Glass Optics\*

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We are developing, in conjunction with the Center for Optics Manufacturing (COM) in Rochester, NY, an acoustic emission (AE) proximity detector to sense wheel-to-workpiece separation before contact is made on a precision grinding machine tool. The motivation for developing such a system is to reduce expensive 'air-grinding' at low in-feed rates (less than 100  $\mu\text{m}/\text{min}$ ). In one scenario, we quickly in-feed and monitor the AE level as the wheel approaches the workpiece, until a predetermined and calibrated AE threshold is reached. Once the AE level surpasses this threshold (indicating a specified separation has been reached), a deceleration command is issued to the CNC which decreases the in-feed rate to a level appropriate for grinding brittle materials. We surmise the AE signal prior to contact is generated by turbulent interactions between the wheel, the fluid and the workpiece. A valuable feature of our proximity detection method is that both spindles are running and full coolant flow is present in the grinding zone (i.e. nominal operating conditions).

As reported in a previous paper<sup>1</sup>, proof-of-concept for using an AE-based proximity sensor has been demonstrated. Since that report, we have successfully implemented AE proximity sensing in a closed loop mode with our CNC. This paper addresses AE system repeatability and reports on its overall performance to date. The implementation of a similar system on a commercially available CNC spherical generator at COM is also discussed.

Along with proximity sensing, the AE system also provides the opportunity to acquire and monitor in-process AE signals during the grinding process. The correlation between the AE signals and workpiece quality and grinding efficiency is shown. The relationship of AE and grinding force is also presented and we hope to use this process information to better understand the material removal process when grinding brittle materials.

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<sup>1</sup> J.S. Taylor, M.A. Piscotty, K.L. Blaedel, L.F. Weaver, D.A. Dornfeld, *Investigation of Acoustic Emission for Use as a Wheel-to-workpiece Proximity Sensor in Fixed-abrasive Grinding*, ASPE 1995 Annual Meeting Proceedings Volume 12, p. 159 (October 1995).

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\* This work was performed under the auspices of the U. S. Dept. of Energy by LLNL under contract No. W-7405-Eng-48.